

## MAPPING REPORT

Frank González and Vasily Titov

### 16-18 May 2001 NTHMP Steering Group Meeting Portland, OR

Input from the States was received, and Individual State Summaries were prepared. These are presented below including, where available, a detailed State report.

The information was also used to update the following cost and production tables from the "Lessons Learned" report presented at the last Steering Group meeting in Hilo, Hawaii.

Table 1. Inundation mapping funding history, in thousands of dollars after taxes.

	<b>FY97</b>	<b>FY98</b>	<b>FY99</b>	<b>FY00</b>	<b>FY01</b>	<b>Totals</b>
<b>ALASKA</b>		97.6		58.8	37.8	194.2
<b>CALIFORNIA</b>		97.6		58.8	37.8	194.2
<b>HAWAII</b>			97.6	58.8	37.8	194.2
<b>OR&amp; WA</b>	195.2		97.6		75.6	368.4
<b>TIME</b>	195.2	195.2	195.2	176.3	188.9	950.8
<b>Totals</b>	390.4	390.4	390.4	352.7	377.7	1901.8

Table 2. Mapping Effort cost and production estimates, including TIME operating costs, excluding State in-kind support.

	<b>4 States</b>	<b>AK</b>	<b>CA</b>	<b>OR</b>	<b>WA</b>
<b>Funding</b>	\$ 1,513.6 K	\$ 388.4 K	\$ 388.4 K	\$ 368.4 K	\$ 368.4 K
<b>Modeling Efforts</b>	13	1	4	6	2
<b>Cost/Modeling Effort</b>	\$ 116.4 K	\$ 388.4 K	\$ 97.1 K	\$ 61.4 K	\$ 170.8 K
<b>Years to Completion</b>	3.5-4.5	3.5	3.5	4.5	4.5
<b>Modeling Effort/Year</b>		0.3	1.1	1.3	0.4

# ALASKA

## MAY 2001 MAP REPORT

### SUMMARY OF EVACUATION & INUNDATION MAPS

COMMUNITY	Popul. (Yr 2000)	Priority	Inund. Begun	Inund. Complete	Evac. Begun	Evac. Complete
<i>Kodiak</i>	6,334			√	?	
<i>USCG Base</i>	1,840			√	?	
<i>Women's Bay</i>	690			√	?	
<i>Seward<sup>1</sup></i>	2,830	1				
<i>Sitka</i>	8,835	2				
<i>Sand Point</i>	952	3				
<i>Homer</i>	3,946	4	√			
<i>Seldovia</i>	286	5	√			
<i>Unalaska</i>	4,283	6				
<i>Yakutat</i>	680	7				
<i>Whittier</i>	182	8				
<i>Cordova</i>	2,454	9				
<i>Cold Bay</i>	88	10				
<i>Ketchikan</i>	7,922	10				
<i>King Cove</i>	792	10				
<i>Petersburg</i>	3,224	10				
<i>Valdez</i>	4,036	10				
<i>Wrangell</i>	2,308	10				
<b>TOTALS</b>	<b>51,682</b>		<b>2</b>	<b>3</b>	<b>3 ?</b>	

<sup>1</sup>NOAA's RAINIER scheduled for 13 August - 30 September 2001 survey of Seward approaches

### HIGHLIGHTS OF GI-UAF REPORT (ATTACHED)

- **KODIAK INUNDATION MODEL RUNS**

- **1964 Scenario:** Good agreement with available inundation data
- **4 Additional hypothetical earthquake scenarios**  
(See GI-UAF Report for earthquake parameters)

- **RESULTS**

- **Worst Case is the 1964 earthquake scenario**

- **PRODUCTION OF LARGE-SCALE MAPS**

- **5 Preliminary Inundation Maps and Data Transferred to Alaska Division of Geological and Geophysical Surveys for Large-Scale Map Production**

**ALASKA**  
**MAY 2001 MAP REPORT**

May 1, 2000

Report from the Geophysical Institute, UAF:

1. The 1964 tsunami wave was modeled using the source function which consists of 18 subfaults, each having its own parameters. Because of the proximity of the three Kodiak communities to the source, the slip distribution of the 1964 earthquake becomes very important in inundation modeling. Results of numerical modeling of the 1964 inundation zone for Kodiak City and US Coast Guard Base agree closely with the observed inundation data gathered after the tsunami event in March 1964. Then, numerical calculations were performed for 5 different hypothetical earthquake scenarios. These scenarios considered potential sources of tsunami waves that can affect the Kodiak Island communities. The following table summarizes some characteristics of source models used to generate the hypothetical tsunamis:

<b>Scenarios for hypothetical earthquakes</b>	<b>Number of subfaults</b>	<b>Moment (Nm)</b>	<b>Mw</b>
The 1964 earthquake modeled as one fault	1	$8.2 \times 10^{22}$	9.2
Lower Kodiak asperity of the 1964 rupture zone	8	$2.2 \times 10^{22}$	8.8
Lower Kodiak asperity of the 1964 rupture zone modeled as one fault	1	$2.2 \times 10^{22}$	8.8
An Alaska megathrust earthquake with rupture area consisting of the 1938 rupture zone plus Shumagin gap	1	$5.6 \times 10^{22}$	9.1
A Cascadia subduction zone earthquake	1	$3.2 \times 10^{22}$	8.9

Numerical analysis has shown that the worst case tsunami scenario for the three Kodiak communities is still the inundation caused by the 1964 event. Comparison between the two source models for the 1964 tsunami indicates that using the source model of 18 subfaults with detailed slip distribution within the rupture area produces the inundation line closest to that observed in 1964.

Inundation maps were constructed for every scenario. The maps have been transferred to the Alaska Division of Geological and Geophysical Surveys for production of the large scale inundation maps.

2. On April 26th, 2000, a meeting of the NTHMP participants from Alaska (Roger Hansen, Elena Suleimani, Rod Combellick, Gary Brown), Kodiak Emergency Consul, Dr. Gary Carver, consulting geologist, Patrick Carlson, the Borough manager, and Linda Freed, the Kodiak City Manager, was held at the Kodiak Borough offices. The ATM group presented results of the inundation modeling for the three communities in Kodiak: Kodiak City, USCG base and Womens Bay. The base maps that were offered for discussion consisted of 6 inundation lines for every community. There was a very useful discussion of the inundation mapping results. It was pointed out that there is a discrepancy in the extent of the modeled 1964 inundation zone for Womens Bay and the observed inundation, according to local sources. Also, two other tsunami scenarios were

suggested: an earthquake in the Yakataga region and the offshore earthquake produced by a set of local faults just offshore of the Kodiak Island. The Kodiak Borough officials plan to make evacuation maps using their own resources. The ATM group will write a technical report that will accompany inundation maps.

# CALIFORNIA

## MAY 2001 MAP REPORT

### SUMMARY OF EVACUATION & INUNDATION MAPS

AREAS <i>Communities</i>	Popul. (Yr 2000)	Priority	Inund. Begun	Inund. Complete	Evac. Begun	Evac. Complete
<b>SAN FRAN. -SAN MATEO</b>	776,733			√	√	
<i>San Francisco</i>						
<i>Daly City</i>						
<i>Pacifica</i>						
<i>Moss Beach</i>						
<i>Half Moon Bay</i>						
<i>Martins Beach</i>						
<i>San Gregorio State Beach</i>						
<i>Pomponio State Beach</i>						
<i>Pescadero State Beach</i>						
<i>Bean Hollow State Beach</i>						
<b>LOS ANGELES-S. MONICA</b>	3,694,820			√	√	
<i>Topanga St. Beach</i>						
<i>Pacific Palisades</i>						
<i>Santa Monica</i>						
<i>Venice</i>						
<i>Marina Del Rey</i>						
<i>Playa Del Rey</i>						
<i>Dockweiler St. Beach</i>						
<i>El Segundo</i>						
<i>Manhattan Beach</i>						
<i>Hermosa Beach</i>						
<i>Redondo Beach</i>						
<i>Torrance Beach</i>						
<i>Palos Verdes</i>						
<b>SANTA BARBARA</b>	92,325			√		
<i>Point Conception</i>						
<i>St. Augustine Beach</i>						
<i>Gaviota Coast</i>						
<i>El Capitan St. Beach</i>						
<i>Goleta</i>						
<i>Santa Barbara</i>						
<i>Serena</i>						
<i>Sandyland</i>						
<i>Capenteria</i>						
<b>SAN DIEGO</b>	1,223,400			√		
<i>Oceanside</i>						
<i>Carlsbad</i>						
<i>Leucadia</i>						
<i>Encinitas</i>						
<i>Cardiff</i>						
<i>Solana Beach</i>						
<i>Del Mar</i>						
<i>Torrey Pines</i>						
<i>La Jolla</i>						
<i>Mission Beach</i>						
<i>Ocean Beach</i>						
<i>Coronado</i>						
<i>Silver Strand</i>						
<i>San Diego Harbor</i>						
<b>CRESCENT CITY<sup>1</sup></b>	4,006				√	
<b>SANTA CRUZ COUNTY</b>		1				
<i>Capitola</i>		1				
<i>Santa Cruz</i>		1				
<i>Davenport</i>		1				
<i>Palm Beach</i>		1				
<b>MONTEREY COUNTY</b>		1	√			
<i>Marina</i>		1	√			
<i>Seaside</i>		1	√			
<i>Pacific Grove</i>		1	√			
<i>Moss Landing</i>		1	√			
<i>Seaside</i>		1	√			
<i>Carmel</i>		1	√			
<i>Slates Hot Springs</i>		1	√			
<i>Lucia</i>		1	√			
<i>Pacific Valley</i>		1	√			

<sup>1</sup>Pre-NTHMP 1-D modeling is basis for evacuation maps.

**CALIFORNIA**  
***MAY 2001 MAP REPORT***

**2000-2002 WORK PLAN**

(Adopted by the California Tsunami Steering Committee at March meeting in Burlingame, CA)

**GENERAL PLAN**

- Transfer all Mitigation funds to the Mapping effort
- Complete preliminary inundation estimates for entire California coast by September 2002

**SPECIFIC TASKS**

- Complete inundation modeling, using current methodology, for

Santa Cruz County  
Monterey County

**Status:** Computational grids under construction

**Schedule:** May 2001: Computational grids completed  
Oct 2001: Preliminary results

- Determine priority for inundation projections to high-population coastlines of

Orange County  
Los Angeles County  
Ventura County  
San Luis Obispo County

**Status:** Under discussion

- Determine optimum approach to estimate inundation of low-population coastlines of

Del Norte County  
Humboldt County  
Mendocino County  
Sonoma County  
Marin County

**Status:** Under discussion

**CALIFORNIA**  
***MAY 2001 MAP REPORT***

**PLANNING MEETING HELD 27 APRIL 2001**

- USC staff met with OES GIS staff and were introduced to the GIS software ArcView. A prototype dataset for the Monterey Bay region was set from 4 distinct data sources. This exercise was very valuable and set up a working relationship between people at the operations level from each group.
- The USC and OES staffers verbally agreed to continue the working relationship at this level to produce data sets for the rest of the California coast. Starting with Monterey, going next to the Central Coast and later to the North Coast.
- USC is going to tailor its operations to produce GIS friendly data sets for future model output. This will facilitate the transfer of information between the two offices.
- USC should have a GIS system working by the end of the summer.

**HAWAII**  
***MAY 2001 MAP REPORT***

- DISTANT MODELING PROJECT (Fai Cheung, P.I.)
  - Fai Cheung has completed the project " Modeling of Distant Generated Tsunami"
- LOCAL MODELING PROJECT (Gerard Fryer, P.I.)
  - Expect to finish Kona and Honolulu by August
  - Expect to have preliminary Kalapana and South Maui results by August



**HAWAII**  
***MAY 2001 MAP REPORT***

Subject: Hawaii Mapping Activities  
Date: Tue, 24 Apr 2001 09:36:33 +0000  
From: cheung@oe.eng.hawaii.edu  
To: gonzalez@pmel.noaa.gov  
CC: byanagi@scd.state.hi.us

Frank,

We have completed the project "Modeling of Distant Generated Tsunami". Below is a summary of the work performed.

Fai.

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We have developed an algorithm to compute the tsunami waveforms at specified locations based on water-level data near the source. The inverse method, which uses water-level data to infer seismic source parameters, has been extended to predict tsunami waveforms away from the source. The study focused on the Aleutian-Alaska source region and its potential threat to Hawaii. In the algorithm, the source region is divided into 41 sub-faults based on previous analyses of major tsunamigenic earthquakes from 1938 to 1986. A linear long wave model was used to develop a database of synthetic mareograms at 14 water-level stations near the source and at six locations, where the tsunami waveforms need to be predicted. In the event of a tsunami, a least-squares routine uses the predetermined mareograms to reconstruct the tsunami signals at the water-level stations and evaluate the expected waveform offshore of Hawaii. A jackknife re-sampling scheme provides the confidence interval bounds of the prediction.

The algorithm has been shown to be internally consistent through simulated water levels of the 1946 Aleutian Earthquake and verified by recorded water-level data of the 1964 Prince William Sound and 1996 Andreanov earthquakes. It accurately predicts the moment magnitude of the earthquakes as well as the first few waves of the subsequent tsunamis. Although the database was constructed using historical events from 1938 to 1986, the algorithm can produce accurate predictions beyond this period. The Pacific Tsunami Warning Center plans to use the algorithm on a testing and evaluation mode. Future research along this line includes extension of the algorithm and database to cover the Japan-Kuril-Kamchatka and Peru-Chile source regions and to provide the expected runup and confidence interval bounds along the Hawaiian coastlines from predicted offshore waveforms.

**OREGON**  
**MAY 2001 MAP REPORT**

**SUMMARY OF EVACUATION & INUNDATION MAPS**

COMMUNITY	Population (Yr 2000)	Priority	Inund. Begun	Inund. Complete	Evac. Begun	Evac. Complete <sup>2</sup>
<i>Astoria</i>	9,813			√		√
<i>Bandon</i>	2,833	5				√
<i>Brookings</i>	5,447	7			√	
<i>Cannon Beach</i>	1,588					√
<i>Coos Bay</i>	15,374			√		
<i>Depoe Bay</i>	1,100				√	
<i>Florence</i>	7,263	3				√
<i>Gardiner</i>						√
<i>Gearhart</i>	995					√
<i>Gold Beach</i>	1,897			√	√	
<i>Lincoln City</i>	7,437					√
<i>Manzanita</i>	564					√
<i>Neskowin</i>					√	
<i>Newport</i>	9,532			√	√	
<i>Pacific City</i>	1,027				√	
<i>Port Orford</i>	1,055				√	
<i>Reedsport</i>	4,378	6				√
<i>Rockaway Beach</i>	1,267	2				
<i>Salmon Cove</i>						√
<i>Seaside</i>	5,900			√		√
<i>Siletz Bay</i> <sup>1</sup>				√		
<i>Waldport</i> <sup>3</sup>	2,050	1	√			√
<i>Warrenton</i>	4,096			√		√
<i>Winchester Bay</i>	488	6				√
<i>Yachats</i>	617					√
<b>TOTALS</b>	<b>82,566 +</b>		<b>1</b>	<b>7</b>	<b>7</b>	<b>15</b>

<sup>1</sup>Pre-NTHMP (Priest, et al., 1995)

<sup>2</sup>If NTHMP inundation map not completed, Priest's 1995 *Tsunami Hazard Maps* was used.

<sup>3</sup>Bathy-Topo data search underway. At current funding level, completion expected in 2002.

# WASHINGTON MAY 2001 MAP REPORT

## SUMMARY OF EVACUATION & INUNDATION MAPS

COUNTY: Population	Population (Yr 2000)	Priority	Inund. Begun	Inund. Complete	Evac. Begun	Evac. Complete
<i>North Cove</i>						
<sup>1</sup> PACIFIC: 20,855						
<i>North Cove</i>				√		√
<i>Tokeland</i>	194			√		√
<i>Raymond</i>	2,975			√		√
<i>South Bend</i>	1,807			√		√
<i>Bay Center</i>	174			√		√
<i>Oysterville</i>				√		√
<i>Nahcotta</i>				√		√
<i>Ocean Park</i>	1,459			√		√
<i>Klipsan Beach</i>				√		√
<i>Long Beach</i>	1,283			√		√
<i>Seaview</i>				√		√
<i>Ihwaco</i>	950			√		√
<sup>1</sup> GRAYS H.: 67,463						
<i>Taholah</i>	824			√		√
<i>Moclips</i>	615			√		√
<i>Sunset Beach</i>				√		√
<i>Ocean Grove</i>				√		√
<i>Roosevelt Beach</i>	79			√		√
<i>Iron Springs</i>				√		√
<i>Copalis Beach</i>	489			√		√
<i>Ocean City</i>	217			√		√
<i>Oyhut</i>	188			√		√
<i>Ocean Shores</i>	3,836			√		√
<i>Hoquiam</i>	9,097			√		√
<i>Aberdeen</i>	16,461			√		√
<i>Cosmopolis</i>	1,595			√		√
<i>Markham</i>	95			√		√
<i>Ocosta</i>				√		√
<i>Bay City</i>				√		√
<i>Westport</i>	2,137			√		√
<i>Cohasset</i>	618			√		√
<i>Grayland</i>	1,002			√		√
<sup>1</sup> JEFFERSON: 26,275						
<i>Kalaloch</i>						
<i>Queets</i>						
<sup>1</sup> CLALLAM: 64,273						
<i>La Push</i>				√		
<i>Neah Bay</i>	794			√	?	
<i>Clallam Bay</i>						
<i>Pysht</i>						
<i>Port Angeles</i>	18,397			√	?	
<sup>1</sup> JEFFERSON: 26,275						
<i>Port Townsend</i>	8,334			√	?	
<sup>1</sup> MASON: 49,826						
<sup>1</sup> PIERCE: 675,962						
<i>Tacoma</i>	193,556					
<i>Gig Harbor</i>	6,465					
<sup>1</sup> KING: 1,654,329						
<i>Seattle</i> <sup>3</sup>	563,374		√			
<sup>1</sup> SNOHOM.: 585,487						
<i>Everett</i>	91,488					
<sup>1</sup> ISLAND: 71,747						
<i>Whidbey Island</i>		1				
<sup>1</sup> SKAGIT: 102,979						
<i>Anacortes</i>	14,557	1				
<sup>1</sup> WHATCOM: 166,514						
<i>Bellingham</i>	67,171	1				
<sup>1</sup> SAN JUAN: 14,077						
<sup>1</sup> KITSAP: 232,933						
<i>Bremerton</i>	37,259					
<i>Port Orchard</i>	7,693					
<sup>34</sup> PUGET SOUND						
<i>All Puget Sound</i> <sup>2</sup>			√			
<b>TOTALS</b>						

<sup>1</sup>OGI Finite Element Computational Grid

<sup>2</sup>TSUNM2 30m Finite Difference Computational Grid

<sup>3</sup>TSUNM2 90m Finite Difference Computational Grid

#### **<sup>4</sup>Landslide Potential Assessment and Source Modeling Needed**

**WASHINGTON  
2002-2006 MAPPING PLANS**

- **FUNDAMENTAL ISSUES TO BE ADDRESSED**

- **Probabilities/Risk/Priorities of Puget Sound vs. Pacific Coast, St. Juan de Fuca**
- **Landslide Potential Assessment**
- **Landslide Source Modeling**
- **Probabilistic Methodologies**
- **GIS Exploitation**

- **EVACUATION MAP PUBLISHING**

- **Seattle**

- **INUNDATION MAPPING**

- **Bellingham**
- **Whidbey Island**
- **Additional Puget Sound Communities ?**
- **Refined V.2.0 Mapping of Specific Pacific Coast Communities ?**